IS 4420 (1967): Methods for determination of conductivity of acqeous and organic extracts of textile materials [TXD 5: Chemical Methods of Test]

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Indian Standard

METHODS FOR DETERMINATION OF CONDUCTIVITY OF AQUEOUS AND ORGANIC EXTRACTS OF TEXTILE MATERIALS

UDC 677·01 : 543

INDIAN STANDARDS INSTITUTION
MANAK BHAVAN, 9 BAHADUR SHAH ZAFAR MARG
NEW DELHI 1

[redacted]

February 1968

Indian Standard
METHODS FOR DETERMINATION OF CONDUCTIVITY OF AQUEOUS AND ORGANIC EXTRACTS OF TEXTILE MATERIALS

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Indian Standard
METHODS FOR DETERMINATION OF CONDUCTIVITY OF AQUEOUS AND ORGANIC EXTRACTS OF TEXTILE MATERIALS

0. FOREWORD

0.1 This Indian Standard was adopted by the Indian Standards Institution on 14 December 1967, after the draft finalized by the Textile Chemistry Sectional Committee had been approved by the Textile Division Council.

0.2 In material specifications for textile electrical-insulating materials, the requirements of the conductivity of aqueous and organic extracts of textile materials are specified. The conductivity values of these extracts give indications of the amount of harmful water solubles and organic impurities present in the textile materials. This standard will be useful in determining the conductivity of aqueous and organic extracts of textile materials.

0.3 Considerable assistance has been derived from the following:

B.S. 2689 : 1956 Recommended methods for estimating the effect of deleterious substances in fibrous electrical insulating materials. British Standards Institution.

B.S. 3266 : 1960 Determination of conductivity, *p*H, water-soluble matter, chloride & sulphate in aqueous extracts of textile materials. British Standards Institution.

0.4 In reporting the result of a test or analysis made in accordance with this standard, if the final value, observed or calculated, is to be rounded off, it shall be done in accordance with IS : 2-1960*.

1. SCOPE

1.1 This standard prescribes method for determination of conductivity of aqueous and organic extracts of textile materials.

2. PRINCIPLE

2.1 The aqueous extract of the textile material is prepared by using low-conductivity water. An organic extract of the textile material is prepared

*Rules for rounding off numerical values (*revised*).

by using trichloroethylene. The conductivity of each of the two extracts is measured separately and expressed in conventional units.

3. SAMPLING

3.1 Sampling for Fibre and Yarn

3.1.1 *Lot (Fibre or Yarn)* — The quantity of fibre or yarn from the same source shall constitute a *lot*. If the lot contains more than 200 kg of fibre or yarn, it shall be divided in sub-lots each weighing 200 kg or less.

3.1.2 From a sub-lot 15 increments, each approximately weighing 10 g, shall be taken from different parts so that a representative sample is obtained. All the increments thus collected shall be thoroughly mixed. This shall constitute the *test sample*.

3.2 Sampling for Fabrics

3.2.1 *Lot (Fabric)* — The quantity of fabrics manufactured essentially under uniform conditions shall constitute a *lot*.

3.2.2 The number of pieces to be selected from a lot shall be as given below. The pieces thus selected shall constitute the *gross sample*:

Lot Size	*Sample Size*
Up to 100	3
101 to 300	4
301 ,, 500	5
501 and above	7

3.2.3 From each piece in the gross sample about 25 g of fabric shall be taken out from at least two different parts. The parts shall then be cut into further smaller pieces and thoroughly mixed. The pieces thus collected shall constitute the *test sample*.

4. TEST SPECIMENS

4.1 From the test sample, draw at least 4 test specimens (2 test specimens for preparing aqueous extracts and the other two for organic extracts) each weighing about 10 g. Cut the test specimens into small pieces.

Note — If the sample, under analysis of loose fibre, take about 5 g of the test specimen.

5. CONDITIONING OF TEST SPECIMENS

5.1 In case of test specimens taken for preparing aqueous extract prior to test, the test specimens shall be conditioned for 24 hours to moisture

equilibrium in a standard atmosphere at 65 ± 2 percent RH and 27° ± 2°C temp (*see also* IS : 196-1966*).

NOTE — No conditioning is required in the case of test specimens taken for preparing organic extract.

6. QUALITY OF REAGENTS

6.1 Unless specified otherwise, pure chemicals shall be employed in test and distilled water (*see* IS : 1070-1960†) shall be used where the use of water as reagent is intended.

NOTE — ' Pure chemicals ' shall mean chemicals that do not contain impurities which affect the test results.

7. CONDUCTIVITY OF AQUEOUS EXTRACT

7.1 Apparatus

7.1.1 *Flat Bottom Flask* — made of chemical-resistant glass and of suitable capacity with a glass stopper incorporating a stopcock.

7.1.2 *Water Cooled Condenser*

7.1.3 *Sintered Glass Crucible* — porosity 4.

7.1.4 *Conductivity Cell* — a convenient conductivity cell of known cell constant (*see* Fig. 1).

NOTE — The cell should be calibrated with M/100 potassium chloride solution which has a conductivity of 0·001 278 mho/cm at 20°C.

7.1.5 *Conductivity Meter* — consisting of a wheatstone bridge network of resistors, fed from an alternating source of frequency not less than 1 000 c/s with a suitable device for assessing bridge balance. One arm of the network is formed by the cell containing the liquid under test (*see* Fig. 2).

7.2 Reagents — distilled water of conductivity not greater than 2 micromhos/cm.

NOTE — The required quality of water may be obtained by passing it through mixed ion-exchange resins.

7.3 Preparation of Aqueous Extract

7.3.1 Condition the test specimens to moisture equilibrium in the standard atmosphere and weigh accurately each test specimen.

*Atmospheric conditions for testing (*revised*).

†Specification for water, distilled quality (*revised*).

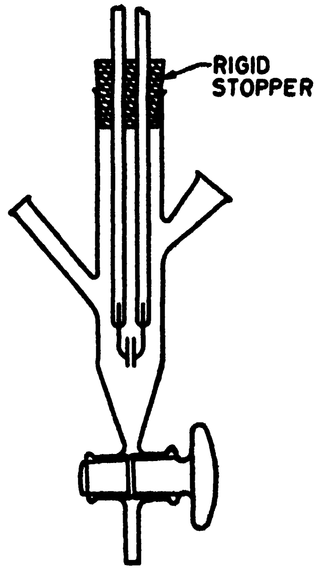
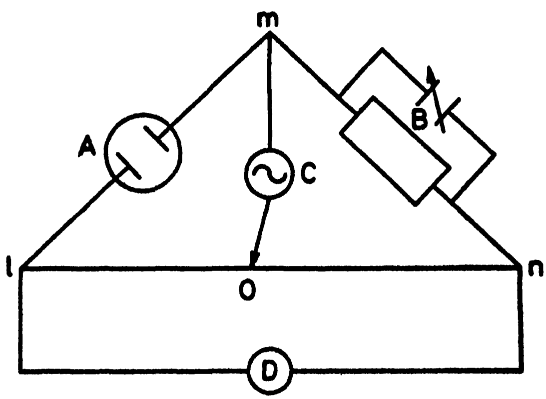


FIG. 1 APPARATUS FOR MEASURING THE ELECTRICAL CONDUCTIVITY OF LIQUIDS



A Electrolytic Cell

B Variable Standard Resistance with a Variable Condenser in Parallel

C Source of Alternating Current

D Current Detector

l, m, n Uniform Graduated Wire or Two Variable Resistance Boxes

FIG. 2 CONDUCTIVITY METER

7.3.2 Put one test specimen in the flask and add sufficient amount of water to it to make liquor to material ratio of 20 : 1 (*see* Note). Connect the flask to the condenser and bring rapidly to boil and continue to boil the liquor gently for 60 minutes. Disconnect and remove the flask while the liquor is still boiling and close it immediately with the glass stopper fitted with the stopcock. Rapidly cool the flask to room temperature. Do not remove or open the tap until ready for filtration.

NOTE — If the test specimen is wool in any form, felt or loose fibre masses of any composition, the liquor to material ratio should be 50 : 1.

7.3.3 Similarly prepare separate extracts of the remaining specimen(s).

7.4 Measurement of Conductivity

7.4.1 Remove the stopper from the flask and transfer some of the extracts to the conductivity cell (*see* Note). Wash the electrodes twice or thrice with the extract. Measure the electrical resistance with the meter. Note the temperature of the extract.

NOTE — The flask should be restoppered as soon as possible.

7.4.2 Calculate the conductivity of the aqueous extract in micromhos per centimetre by the formula given below:

$$\text{Conductivity of extract, micromhos/cm at } 27^\circ\text{C} = \frac{K \times 10^6}{R\,[\,1 + 0{\cdot}02\,(\,t - 27\,)\,]}$$

where

K = cell constant (per centimetre);

R = measured resistance in ohms; and

t = temperature, in degrees celsius of extract.

NOTE — The cell constant, if not known, should be first determined by measuring the resistance of M/100 potassium chloride solution.

7.4.3 Calculate separately the conductivity of the extract(s) prepared from the remaining test specimen(s).

7.4.4 Calculate the average of the values obtained as in **7.4.2** and **7.4.3**.

8. CONDUCTIVITY OF ORGANIC EXTRACT

8.1 Apparatus

8.1.1 *Reflux Condenser*

8.1.2 *Conductivity Cell* — a convenient conductivity cell of known cell constant (*see* **7.1.4**).

8.1.3 *An Electronic Multi-Megohmmeter* — using 85-V dc, or a sensitive galvanometer and battery.

8.1.4 *Air-Oven* — capable of maintaining a temperature of 80° to 100°C.

8.2 Reagents

8.2.1 *Trichloroethylene* (*see* IS : 245-1962*).

NOTE — The trichloroethylene used for the extraction should be purified by stirring in about 1 percent by weight of fuller's earth and filtering through a sintered glass filter. The conductivity of the solvent when determined shall be not greater than 5×10^{-12} mho/cm.

8.3 Preparation of Organic Extract

8.3.1 Take one test specimen (*see* Note 1). Heat it gently in oven for about 2 hours at a temperature of 80° to 100°C to remove any amount of absorbed water and immediately transfer it to a suitable flask. Add trichloroethylene to the flask keeping the liquor to material ratio of 10 : 1 (*see* Note 2). Connect the flask to the condenser. Extract the test specimen by gently boiling the trichloroethylene for about 1 hour (*see* Note 3). Stopper the flask firmly and allow it to remain overnight in the dark. Make up the loss of volume through evaporation by addition of trichloroethylene before determining the conductivity.

NOTE 1 — Since the test specimen is dried before extraction, it is not necessary to condition it.

NOTE 2 — If the test specimen is wool in any form, felt on loose fibre masses of any composition, the liquor to material ratio should be 25 : 1.

NOTE 3 — The apparatus used should be all-glass apparatus and the joints should be made of ground glass.

8.4 Measurement of Conductivity

8.4.1 Rinse the conductivity cell several times with trichloroethylene and dry. Take the extract in conductivity cell and measure its resistance after application of current for 1 minute.

8.4.2 Calculate the conductivity of the organic extract by the formula given in **7.4.2**.

8.4.3 Similarly determine the conductivity of the organic extracts prepared from remaining test specimen(s).

8.4.4 Calculate the average of the values obtained as in **8.4.2** and **8.4.3**.

9. REPORT

9.1 Report the value obtained as in **7.4.4** and **8.4.4** as the conductivity of aqueous and organic extracts respectively.

9.1.1 Report also the liquor to material ratio used in preparing the extracts.

*Specification for trichloroethylene technical (*revised*).

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Printed at Delhi Printers, Delhi 6, India

AMENDMENT NO. 1 OCTOBER 1983
TO
IS : 4420 - 1967 METHODS FOR DETERMINATION OF CONDUCTIVITY OF AQUEOUS AND ORGANIC EXTRACTS OF TEXTILE MATERIALS

(This amendment has been carried out to specify the SI units in the standard.)

Alterations

(*Page* 5, *clause* **7.1.4**, *Note*) — Substitute the following for the existing note:

'NOTE — The cell should be calibrated with N/100 potassium chloride solution which has conductivity of 127 800 µS/m at 27°C.'

(*Page* 5, *clause* **7.2**, *line* 2) — Substitute '200 µS/m' *for* '2 micromhos/cm'.

(*Page* 7, *clause* **7.4.2**) — Substitute the following for the existing clause:

'**7.4.2** Calculate the conductivity of aqueous extract in µS/m by the formula given below:

$$\text{Conductivity of aqueous extract at } 27^\circ\text{C} = \frac{K \times 10^8}{R\,[\,1 + 0{\cdot}02\,(\,t - 27\,)\,]}$$

where

K = cell constant in cm^{-1},

R = measured resistance in ohms, and

t = temperature of extract in °C.

NOTE — The cell constant, if not known, should be first determined by measuring the resistance of N/100 potassium chloride solution.'

(*Page* 8, *clause* **8.2.1**, *Note*, *line* 4) — Substitute '5×10^{-4} µS/m' *for* '5×10^{-13} mho/cm'.

(TDC 5)

Printed at New India Printing Press, Khurja, India